

# Medical Pharmacology and Physiology

Medical Pharmacology and Physiology  
School of Medicine  
MA415 Medical Sciences Building  
573-882-4957

<https://medicine.missouri.edu/departments/medical-pharmacology-physiology/about> (<https://medicine.missouri.edu/departments/medical-pharmacology-physiology/about/>)

The joining of these two disciplines provides a powerful way to address modern questions of biology.

The department offers a MS degree program in Medical Pharmacology and Physiology. This program is designed to prepare students for rewarding teaching and/or research careers in academia, government or the pharmaceutical and biotechnical industries.

## Faculty

**Professor** A. Adebiyi\*, D. Bowles\*, A. Chade\*\*, S. Chen\*\*, T. Cui\*\*, M. Davis\*\*, W. Durante\*\*, W. Fay\*\*, K. Gillis, C. Hardin, M. Hill\*\*, T. Hwang\*, J. Ibdah, D. Kline, L. Martinez-Lemus\*\*, K. McDonald\*\*, S. Segal\*\*, S. Shukla\*\*

**Associate Professor** E. Boerman\*\*, T. Domeier\*\*, S. Halenda, R. Lim\*, N. Nichols, A. Parrish\*\*, L. Polo-Parada\*\*, G. Sowa\*\*, P. Wilden\*

**Assistant Professor** B. Bostick\*\*, O. Glinskii, L. Hanft, C. Hans\*, T. Kalogeris\*, P. Kanthakumar, M. Methawasin\*\*, C. Norton\*\*, Z. Sun, A. Upendran\*\*, S. Zawieja\*\*

**Professor Emeritus** E. Blaine\*, E. L. Forker\*, L. Holland\*, T. Hurley\*, V. Huxley\*\*, M. James-Kracke\*, A. Jones\*, R. Korthuis\*, G. Meininger\*, M. Milanick\*\*, J. Turner

\* Graduate Faculty Member - membership is required to teach graduate-level courses, chair master's thesis committees, and serve on doctoral examination and dissertation committees.

\*\* Doctoral Faculty Member - membership is required to chair doctoral examination or dissertation committees. Graduate faculty membership is a prerequisite for Doctoral faculty membership.

## Undergraduate

While MU does not offer undergraduate degrees specifically in medical pharmacology and physiology, the University does offer baccalaureate opportunities in a number of related areas in the other Schools and Colleges that make up the University. The catalog provides a complete list of these degree options (<https://catalog.missouri.edu/degreesanddegreeprograms/>).

## Graduate

- MS in Medical Pharmacology and Physiology  
(<https://catalog.missouri.edu/schoolofmedicine/medicalpharmacologyphysiology/ms-medical-pharmacology-physiology/>)

Dawn Sapp  
School of Medicine  
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573-882-4957

<https://medicine.missouri.edu/departments/medical-pharmacology-physiology/about/>

The joining of these two disciplines provides a powerful way to address modern questions of biology. The department offers a MS degree program in Pharmacology and Physiology. This program is designed to prepare students for rewarding teaching and/or research careers in academia, government or the pharmaceutical and biotechnical industries.

## Pharmacology

Pharmacology is a basic medical science that deals with actions of drugs, hormones and neurotransmitters on living processes. Knowledge based on the results of pharmacological research leads to increased effectiveness and safety in the treatment of diseases in man and animals. Pharmacology is different from pharmacy, which is a profession concerned with the preparation and dispensing of drugs.

## Physiology

The discipline of Physiology focuses on understanding the integrative function of living organisms from the molecular to the organismal level. As such, physiological research addresses how genes, organelles, cells, tissues and organs are integrated to accomplish the complex functions of living organisms. From a medical perspective, understanding normal function is a prerequisite to understanding disease.

## Departmental Research

The departmental faculty has expertise in a variety of mammalian systems, with emphases in cardiovascular and endocrine physiology and molecular and cellular pharmacology. Individual labs utilize a number of different experimental models ranging from the whole animal studies to cellular, subcellular, biochemical and modern molecular approaches. Human research is also emphasized.

Research problems under current investigation include microvascular control of blood flow; modulation of vascular function by the extracellular matrix; role of the microcirculation in inflammation and diabetes; mechanisms involved in angiogenesis membrane regulation and ion transport; barriers separating circulating blood and tissue; energetics and metabolism of vascular smooth and cardiac muscle; electrophysiology of isolated cardiac vascular smooth muscle and endothelial cells; exercise physiology and regulation of contractile protein functions; and hormonal induction of genetic transcription, intracellular signaling mechanisms and genetic regulation of cell proliferation, cell cycle, cell differentiation and apoptosis; and the pathogenetic mechanisms of alcohol on liver cells.

## Partnerships

Cooperative interactions exist with other clinical and basic science departments in the School of Medicine as well as with the NextGen Precision Health Center, the Truman Veterans Hospital, the Dalton Cardiovascular Research Center, the College of Veterinary Medicine, Nutrition and Exercise Department and various campus-wide programs in Molecular Biology and Food for the 21st Century. The cooperative research atmosphere encourages staff and students to work across departmental lines and provides a unique opportunity for interdisciplinary training of the students.

## Teaching Experience

In addition to course work and research training, all graduate students are required to participate as teaching assistants in laboratory or lecture instruction offered by the department. Such experience enhances the students' presentation and teaching skills, contributes to their professional maturity, and reinforces a sense of collegiality between students and faculty.

## Financial Aid from the Program

Financial support in this program for qualified graduate students is available from several sources. Students also may be eligible for institutional teaching and research assistantships. In addition, there are a number of fellowship awards from the Graduate School and the campus-wide Life Science Program available on a competitive basis through nominations by the Department.

Deadlines for these fellowships are January to mid-February each year. Applicants do not directly apply for these fellowships. Rather the department applies on behalf of successful applicants for admission. Therefore a prospective candidate should submit an application for admission to the department in the preceding fall. Finally, some of our students are supported by research grants of individual faculty members or by predoctoral fellowships from extramural sources.

### MPP 3202: Elements of Physiology

Beginning course for sophomore and above designed to cover the basic functional aspects of major organ systems of the body.

**Credit Hours:** 5

**Prerequisites:** sophomore standing

### MPP 3202H: Elements of Physiology - Honors

Beginning course for sophomore and above designed to cover the basic functional aspects of major organ systems of the body.

**Credit Hours:** 5

**Prerequisites:** sophomore standing; honors eligibility required

### MPP 3290: Undergraduate Research

Laboratory experience and opportunity to explore research in medical pharmacology and physiology.

**Credit Hour:** 1-3

### MPP 3500: Sports Performance Physiology

This is an online course that will introduce students to the basic concepts in sports performance physiology, with a focus on the integrated function of organ system in homeostasis and human health. Several sections of the course will expose students to important issues in sports performance physiology, specifically the impact of physical activity on cardiovascular and metabolic functions.

**Credit Hours:** 3

**Recommended:** Cell Biology, Biochemistry

### MPP 3550: Physiology for Engineers

This is an online course that will introduce students to the basic concepts of physiology, with a focus on the integrated function of organ systems in homeostasis and human health. Several sections of the course will expose students to important issues from engineering perspective with emphasis in the analytical and quantitative engineering skills applicable to different physiological systems.

**Credit Hours:** 3

**Recommended:** Cell Biology, Biochemistry, Basic Mathematics

### MPP 4085: Undergraduate Problems in Medical Pharmacology and Physiology

This course is designed to provide well-qualified undergraduate students the opportunity to engage in advanced study in topics in pharmacology or physiology with individual faculty members. Topics will be drawn from recent primary literature. Graded on A-F basis only.

**Credit Hour:** 1-3

**Prerequisites:** instructor's consent

### MPP 4085W: Undergraduate Problems in Medical Pharmacology and Physiology - Writing Intensive

This course is designed to provide well-qualified undergraduate students the opportunity to engage in advanced study in topics in pharmacology or physiology with individual faculty members. Topics will be drawn from recent primary literature. Graded on A-F basis only.

**Credit Hour:** 1-3

**Prerequisites:** instructor's consent

### MPP 4202: Medical Physiology

(cross-leveled with MPP 7422). Medical Physiology is intended for health scientists. Fat, bone, digestion, nutrition, appetite and brain health will be emphasized for health reform and updates for nervous, muscle, heart, vasculature, liver, renal, lung and endocrine systems with analysis for preventative medicine. May be repeated for credit. Graded on A-F basis only.

**Credit Hours:** 4

**Prerequisites:** Nutrition or Biochemistry

### MPP 4202H: Medical Physiology - Honors

(cross-leveled with MPP 7422). Medical Physiology is intended for health scientists. Fat, bone, digestion, nutrition, appetite and brain health will be emphasized for health reform and updates for nervous, muscle, heart, vasculature, liver, renal, lung and endocrine systems with analysis for preventative medicine. May be repeated for credit. Graded on A-F basis only.

**Credit Hours:** 4

**Prerequisites:** Nutrition or Biochemistry. Honors eligibility required

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**MPP 4204: Medical Pharmacology**

(cross-leveled with MPP 7424). Medical pharmacology teaches the science of drug actions in medicine today, and principles of pharmacokinetics/dynamics. Future health professionals will learn prescription judgment and quality/cost improvements for patient safety. An online laboratory will teach drug database information technology.

**Credit Hours:** 4

**Prerequisites or Corequisites:** BIO\_SC 3700 or MPP 3202 or MPP 4202 or equivalent physiology course from other colleges

**Recommended:** nutrition or biochemistry courses are recommended but not required

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**MPP 4204H: Medical Pharmacology-Honors**

Medical pharmacology teaches the science of drug actions in medicine today, and principles of pharmacokinetics/dynamics. Future health professionals will learn prescription judgment and quality/cost improvements for patient safety. An online laboratory will teach drug database information technology.

**Credit Hours:** 4

**Prerequisites or Corequisites:** BIO\_SC 3700 or MPP 3202 or MPP 4202 or equivalent physiology course from other colleges; Honors eligibility required

**Recommended:** nutrition or biochemistry courses are recommended but not required

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**MPP 7422: Medical Physiology**

(cross-leveled with MPP 4202). Medical Physiology is intended for health scientist. Fat, bone, digestion, nutrition, appetite and brain health will be emphasized for health reform and updates for nervous, muscle, heart, vasculature, liver, renal, lung and endocrine systems with analysis for preventive medicine. May be repeated for credit. Graded on A-F basis only.

**Credit Hours:** 4

**Prerequisites:** Nutrition or Biochemistry

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**MPP 7424: Medical Pharmacology**

(cross-leveled with MPP 4204). Pharmacology teaches the science of drug actions in medicine today and principles of pharmacokinetics/dynamics. Future medical researchers will learn molecular probes for medical research and translational science to improve health care. An online laboratory will teach drug database information technology. Graded on A-F basis only.

**Credit Hours:** 4

**Prerequisites or Corequisites:** BIO\_SC 3700 or MPP 3202 or MPP 4202 or equivalent physiology course from other colleges

**Recommended:** nutrition or biochemistry courses are recommended but not required

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**MPP 8000: Scientific Discovery Leading to Life Science Innovations**

(same as BIOL\_EN 8000). This course explains the scientific discovery process from idea to product release, examining problem identification, need validation, and commercialization. Clinical, business and engineering perspectives are examined to understand translating innovation into clinical practice. May be repeated for credit. Graded on A-F basis only.

**Credit Hours:** 3

**Prerequisites:** must be enrolled in a graduate degree program

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**MPP 8004: Regulatory Issues in Clinical Research and Clinical Trials**

(same as BIOL\_EN 8004). The goal of the course is to highlight key FDA regulatory issues for conducting human clinical trials and clinical research. For clinical trials, FDA has set up several compliance programs and guidance documents as a part of human subject protection (HSP)/ Bioresearch Monitoring (BIMO) initiatives. The aim of the program was to strengthen FDA oversight and protection of subjects in clinical trials and to preserve confidentiality of data. The HSP/BIMO initiative comprehends all FDA regulated clinical trials including human drugs and biological drug products, devices, foods, and veterinary medicine. The course is designed for students in medical professions, management, biomedical engineering, and related areas. Adequate knowledge regarding FDA guidance in conducting human clinical trials and clinical research will help professionals steer drug/device development and commercialization in their respective field. This course will be offered online only. An introduction to essential disciplines for conducting clinical trials and clinical research will be provided. The basics of good clinical practices (GCPs), biostatistics and clinical epidemiology in relation to clinical trials will be presented. Several relevant case studies for conducting clinical trials, both nationally and internationally, will be discussed. The importance of data collection and data management while conducting clinical trials will be explained. Graded on A-F basis only.

**Credit Hours:** 3

**Recommended:** Knowledge in biomedical sciences, clinical sciences

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**MPP 8085: Graduate Problems in Medical Pharmacology and Physiology**

Guided study to strengthen knowledge in physiology and pharmacology. Graded on A-F basis only.

**Credit Hour:** 1-3

**Prerequisites:** instructor's consent

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**MPP 8090: Thesis Research in Medical Pharmacology and Physiology**

Research for Master's Students in physiology or pharmacology, leading to dissertation. Graded on a S/U basis only.

**Credit Hour:** 1-99

**Prerequisites:** instructor's consent

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**MPP 8100: Design and Development of Biomedical Innovations**

(same as BIOL\_EN 8100, ENGINR 8100). The overarching goal of this course is to help participants understand the design and development (drug or device) process in biomedical innovation. This course will help participants to understand the process of choosing unmet clinical needs, articulate a need statement without integrating solution, design and develop a solution. Participants will learn to assess the commercial potential of clinical needs by performing market analysis and valuing customer needs. A conceptual understanding about development of a prototype for a device and also drug development by different brainstorming process will be provided. Details of regulatory, reimbursement, patenting process required for product development will be explained with examples. An overview about how to evaluate preliminary designs, define product specifications, comply with manufacturing principles and methods, costs, cGMP requirements will be explained. Quality control and Quality assurance necessities for drug/device will be elucidated with case studies. Participants will gain knowledge about different business models for drug and devices, estimate market penetration and how to make profitable, patient-driven products. Graded on A-F basis only,

**Credit Hours:** 3

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**MPP 8200: Medical Pharmacology I**

This course is the first of two courses; Students will be able to understand the basic concepts of pharmacology and the pharmacological basis of therapeutics. Students will be introduced to the core principles of drug action in terms of bioavailability, pharmacokinetics, pharmacodynamics, and the mechanism of action of drugs in the treatment of diseases.

**Credit Hours:** 3**Recommended:** Cell Biology, Biochemistry

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**MPP 8250: Medical Pharmacology II**

This course is the second of two courses; Students will be able to understand the basic concepts of pharmacology and the pharmacological basis of therapeutics. Students will be introduced to the core principles of drug action in terms of bioavailability, pharmacokinetics, pharmacodynamics, and the mechanism of action of drugs in the treatment of diseases.

**Credit Hours:** 3**Recommended:** Cell Biology, Biochemistry

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**MPP 8300: Medical Physiology I**

In this first two courses students will be able to understand the basic concepts of physiology and ensure that they understand how the body works. Students will be able to understand the function, regulation, and integration of human body organ systems.

**Credit Hours:** 3

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**MPP 8350: Medical Physiology II**

In this second of two courses students will be able to understand the basic concepts of physiology and ensure that they understand how the body works. Students will be able to understand the function, regulation, and integration of human body organ systems.

**Credit Hours:** 3

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**MPP 8375: Medical Pharmacology and Physiology Laboratory**

The main aim of this laboratory is to link several key aspects of general human physiology functions necessary for everyday living with fundamental aspects of pharmacology.

**Credit Hours:** 3**Recommended:** Pharmacology, Physiology

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**MPP 8411: Mammalian Pharmacology and Physiology**

An integrated course covering the basic concepts in physiology and pharmacology of the cardiovascular, gastrointestinal, endocrine, renal, and respiratory systems with an emphasis of applying the key concepts to clinically relevant examples. Graded on A-F basis only.

**Credit Hours:** 5**Prerequisites:** instructor's consent

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**MPP 8412: Seminar in Medical Pharmacology and Physiology**

Instruction in critical evaluation, review, and summary of scientific data and practice in oral presentation of scientific research seminar. Taught in conjunction with weekly department seminar series.

**Credit Hour:** 1

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**MPP 8415: Responsible Conduct of Research thru Engagement, Enactment and Empowerment NIH and other Federal Age**

The emphasis is on the scientific research ethics problems in interdisciplinary work. Student involvement can include designing mock misconduct trials or writing advocacy letters to change current policy.

**Credit Hours:** 2**Prerequisites:** instructor's consent

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**MPP 9001: Topics in Physiology**

A graduate level course with the goal to train Integrative Physiology graduate students to become effective teachers. This course is a component of professional development as well as a curriculum vitae asset for graduate students pursuing careers in academia, industry, teaching entrepreneurship, and more. The teaching associated with this course will provide opportunities in both didactic and hands-on, one-and-one teaching experiences. This course will equip graduate students with tools to effectively teach students and generally engage

and communicate better with others. A graduate student enrolled in this course will be expected to work as a Teaching Assistant (TA) in the undergraduate discussion sessions associated with the 5-credit undergraduate MPP 3202 Elements of Physiology course. Graded on S/U basis only.

**Credit Hours:** 2

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**MPP 9090: Thesis Research in Medical Pharmacology and Physiology**

Research for PhD students in physiology or pharmacology, leading to dissertation. Graded on a S/U basis only.

**Credit Hour:** 1-99

**Prerequisites:** instructor's consent

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**MPP 9422: Medical Pharmacology and Physiology Journal Club**

On a weekly basis, individual students are assigned current high profile journal articles to present to their fellow students and faculty in a journal club setting. Each student in the course is required to read the paper in advance and participate in discussions of the figures and general topics that is being presented. Graded on S/U basis only.

**Credit Hour:** 1

**Prerequisites:** enrolled in MPP PhD graduate program

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**MPP 9426: Transmembrane Signaling**

This course is for advanced level graduate students. The course is designed to develop state of the art knowledge and understanding of current research issues in the cell signaling. The major emphasis is on receptor and non-receptor mediated transmembrane signaling events underlying physiological and pharmacological responses of the cells. Students are also involved in class presentations, and the development and critical review of new research proposals, all focused on cellular signaling.

**Credit Hours:** 4

**Prerequisites:** basic courses in biochemistry and or cell and molecular biology or equivalent

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**MPP 9430: Cardiovascular Physiology**

This course is designed to provide the student with an in depth knowledge of specific aspects of cardiovascular physiology with major emphasis on cardiac structure and function. Topics are covered in 1, 3-4 hour session per week and are based on reading assignments from the literature. The following topics have been addressed in previous offerings but the specific topics may vary from year to year: Heart muscle structure and remodeling, myofilament protein structure/function, sarcomere as a therapeutic target, excitation contraction coupling, cardiomyocyte Ca<sup>2+</sup> handling, cardiac myocyte energetics, myocyte survival and cell death pathways, cell-to-cell communication, cardiac remodeling, heart failure, myocardial extracellular matrix, effects of exercise training on cardiac function, regulation of coronary blood flow.

**Credit Hours:** 4

**Prerequisites:** MPP 7422 or the equivalent (e.g., UM first year medical school curriculum, V\_BSCI 8420, or BIO\_SC 3700-with supporting courses)

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**MPP 9431: Control of Energy Metabolism**

(same as V\_BSCI 9431). This advanced elective is in a lecture/discussion format using primary literature to explore how cells organize and regulate metabolism to meet energy demands.

**Credit Hours:** 3

**Prerequisites:** instructor's consent

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**MPP 9434: Microvascular Physiology**

(same as V\_BSCI 9425). An in-depth study of microcirculatory structure and function in various organs with emphasis on understanding the mechanisms involved in the regulation of local blood flow, nutrient supply, lymphatic function, and tissue fluid balance.

**Credit Hours:** 4

**Prerequisites:** V\_BSCI 8420 and V\_BSCI 8421 or equivalent and instructor's consent

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**MPP 9435: Molecular Exercise Biology**

(same as V\_BSCI 9435). Skeletal muscle mechanics, contractions theories, transgenic models, development, gene expression regulation, adaptation to exercise, aging, metabolic functions, and inactivity induced chronic diseases.

**Credit Hour:** 1-3

**Prerequisites:** course director's consent required for enrollment

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**MPP 9437: Neural Cardiorespiratory Control**

(same as V\_BSCI 9467). Course objectives include developing a general understanding of CNS mechanisms in the regulation of the cardiovascular and respiratory system, including autonomic, neurohumoral and body fluid homeostatic mechanisms, gaining knowledge of the major advances and topics in the field and becoming familiar with some of the methods used to study CNS cardiorespiratory regulation. Graded on A-F basis only.

**Credit Hours:** 3

**Prerequisites:** instructor's consent

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